State of Wisconsin/Department of Transportation

RESEARCH PROGRESS REPORT FOR THE QUARTER ENDING: September 30, 2004

Program: SPR-0010(36) FFY99	**Part: II Research and Development**
Project Title: Testing Wisconsin Asphalt Mixtures for the AASHTO 2002 Mechanistic Design Procedure	**Project ID:** 0092-04-07
Administrative Contact: Nina McLawhorn	**Sponsor:** WisDOT/WHRP
WisDOT Technical Contact: Len Makowski	**Approved Starting Date:** 4/2/2004
Approved by COR/Steering Committee: $125,000	**Approved Ending Date:** 10/2/2005
Project Investigator (agency & contact): Michigan Technological University, R. Christopher Williams, 301B Dillman Hall, 1400 Townsend Dr., Houghton MI 49931, Ph. 906-487-1630, Fax 906-487-1620	

Description:

The Wisconsin Department of Transportation (WisDOT) currently uses the AASHTO 1972 Interim Guide for the Design of Pavement Structures for hot mix asphalt. This pavement design procedure is a strictly empirical pavement design approach, however with the latest research and available computer capabilities, mechanistic pavement design procedures have become more feasible. The AASHTO 2002 Guide for Design of New and Rehabilitated Pavement Structures and associated software has been built on the mechanical properties of the pavement layers while still using functions to predict pavement life, thus making it a mechanistic-empirical pavement design approach. This pavement design procedure also allows for default values of the mechanical properties to be used, which is based on previous measurements of these properties.

The intent of this project is to examine typical hot mix asphalt (HMA) pavements that are constructed in the state of Wisconsin. The analysis will compare the suggested pavement structures based on the current (1972) pavement design guide and that of the new (2002) pavement design guide. In order to develop the pavement structure as outlined by the 2002 Pavement Design Guide the mechanical properties of the HMA layers must be measured. These properties include Dynamic Modulus, Flow Time, and Flow Number, which have been found to be significant predictors of rutting and fatigue by Witczak et. al. (2002). Properties of the other layers in the system will be obtained from the WisDOT pavement design inputs.

A cross-section of typical HMA pavements has been formulated into a research project matrix, for the greatest benefit for the WisDOT. Michigan Technological University (MTU) will sample these mixtures during the 2004 paving season. These mixtures will then tested in accordance with the AASHTO 2002 Design Guide for the aforementioned testing procedures and compiled into a library of values for the WisDOT.

Total study budget	Current FFY budget	Expenditures for current quarter	Total Expenditures to date	Percent Complete
$83,500.00*	**$83,500.00**	**$19,305.11**	**$31,912.68**	**38.2%**

*This includes $8,500.00 in cost share.

Progress This Quarter:

During the third quarter of 2004, MTU has been working on a review of literature associated with Dynamic Modulus, Flow Time, and Flow Number as well as the collection of samples that are applicable to the research study. What follows is a more thorough description of each task outlined in the research project proposal.

Literature Review:

The focus of the literature review has focused on NCHRP projects 1-37A, 9-19, and 9-29, which are the main research projects that have been used for compiling the AASHTO 2002 Design Guide. Past work has been reviewed that has dealt with the three mechanical tests that are associated with the new pavement design guide.

Currently this portion of the project is 75% complete.

Materials Collection:

It was determined for this study that 12-5gallon buckets of the loose HMA would be sampled from each job. The loose HMA is sampled directly from the back of one truck prior to it leaving the plant for the job site. In addition to the loose HMA being sampled, a 5gallon

bucket of the liquid asphalt cement is sampled either directly of the storage tanks on-site or from the back of the truck delivering the liquid. The JMF for each job as well as the load ticket for the truck from which the material was sampled is also collected.

At this time it has become clear that 25.0mm mixtures are not frequently paved in the State of Wisconsin, the same is true for open-graded mixtures. It is the belief of the MTU research staff that some of these jobs should be reallocated to other cells, which would maintain the overall number of jobs for this project, while also making the later statistical analysis of the testing more robust. The following revised project matrix is being pursued. Eighteen of the 20 jobs that are relevant to this project have been sampled and are outlined in the following figure.

Nominal Maximum Aggregate Size	Mix Type	Traffic Level			
		E-0.3	E-1	E-3	>E-3
25.0mm	Dense				
	Open				
19.0mm	Dense	X	XX	XXX	XXO
	Open				
12.5mm	Dense	XX	XX	XXX	XXO
	Open				X

Figure 1 Revised Project Matrix

In the above matrix, an X represents mixtures that have been sampled from a single job and an O represents mixtures that have not been sampled. Projects had been identified for the remaining cells, but either through miscommunication or changes in the pavement designs they were not sampled. MTU is currently trying to identify new projects to fill these cells. These final two mixes do not constitute a significant amount of the mixes paved in the State of Wisconsin thus are difficult to find. If these cells cannot be filled MTU will try to sample them during the 2005 construction season.

Currently this portion of the project is 85% complete.

Laboratory Testing:
Seventeen of the eighteen jobs that have been sampled have been compacted and are ready to be cut down and tested in accordance with the AASHTO 2002 Design Guide testing procedure, this amounts to 408 specimens. This testing procedure has been published and is available at the following web site: http://www.trb.org/mepdg/. This document is rather vague so MTU will have to determine testing temperatures, loads, frequencies, and confining pressures. This will be accomplished through an experimental analysis, which varies the aforementioned testing parameters.

Currently this portion of the project is 15% complete.

Work Next Quarter:

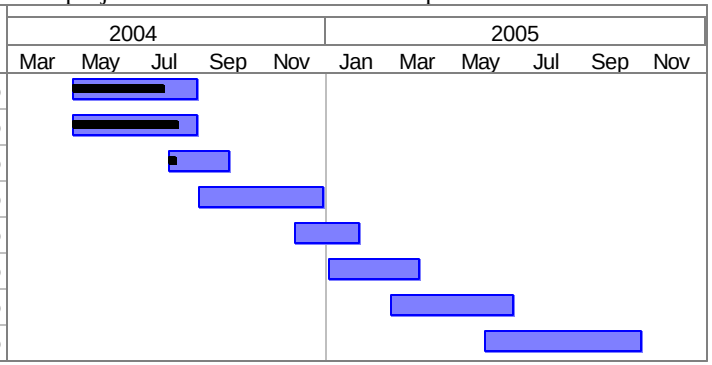
During the course of the 3rd Quarter of 2004, MTU will continue to sample materials that are deemed applicable to this research project. Specimens will be prepared from the sampled material and will begin to be prepared for testing in accordance with the AASHTO 2002 Design Guide. As new and relevant research publications become available, they will be incorporated into the literature review associated with this study.

Circumstances affecting progress/budget:
We are currently waiting for a coring/sawing rig to be delivered from Shedworks, Inc. This piece of equipment is expected to arrive at the end of October and is critical in specimen preparation. Thus, no specimens have been tested at this time.

Gantt Chart:

Below is a Gantt chart of the tasks that are associated with research project as well as the relative completion of each task.

ID	Task Name	% Complete
1	Literature Review	75%
2	Dev. of Research Plan & Materials Collection	85%
3	Laboratory Testing of Specimens	15%
4	Analysis of Laboratory Data	0%
5	Interim Report	0%
6	AASHTO Design Guide Simulation	0%
7	Development of Library of Values	0%
8	Final Report	0%



Note: Gantt chart shown in State Fiscal Year Quarters